

CLAIMS

Sub
B1

1. A compound that binds allosterically to MMP-13 and that comprises first and second hydrophobic groups and first and second hydrogen bond acceptors, wherein:

(a) the relative positions of centroids of the above features are defined by the following Cartesian coordinates in Å:

(i) first hydrogen bond acceptor, 0.00, 0.00, 0.00;
(ii) second hydrogen bond acceptor, 5.08, 2.23, 0.00;
(iii) first hydrophobic group, -1.52, -3.06, -0.23;
(iv) second hydrophobic group, 9.07, 0.00, 0.00; and

(b) tolerances in the positions of the hydrophobic groups and the hydrogen bond acceptors are $\pm 1.0 \text{ \AA}$ and $\pm 1.5 \text{ \AA}$ respectively.

2. The compound of claim 1, wherein the first hydrophobic group contains a bicyclic ring system containing between 8 and 10 atoms and which may contain one or several heteroatoms, or a 5- or 6-membered monocyclic aromatic group which may contain one or more heteroatoms and which may be 4-substituted or 3,4-disubstituted, but which is of width (including substituents) less than 4.0 Å.

3. The compound of claim 2, wherein the pi-system of the aromatic ring is electron rich.

4. The compound of claim 1, wherein first hydrophobic group, is linked by a first linker chain which is three atoms long to a first 5- or 6-membered ring of the scaffold, the first linker chain atom adjacent to said first scaffold ring forming part of the first hydrogen bond acceptor.

5. The compound of claim 4, wherein the first linker chain has a methylene group located adjacent to the hydrophobic group.

Sub B1

6. The compound of claim 4, wherein the scaffold further comprises a second scaffold ring fused to the first scaffold ring at locations two and three ring atoms distant from the junction between the first scaffold ring and the first linker chain, and the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is two positions distant from said junction forms part of the second hydrogen bond acceptor.

7. The compound of claim 6, wherein the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is three positions distant from said junction has a substituent which is a single atom or is a methyl group.

8. The compound of claim 1, wherein the second hydrophobic group is a 5- or 6-membered aromatic ring which may contain one or several heteroatoms, a bicyclic ring system containing between 8 and 10 atoms and which may contain one or several heteroatoms, or a planar saturated or unsaturated system.

9. A compound that binds allosterically to MMP-13 and that comprises a hydrophobic group and first, second and third hydrogen bond acceptors, wherein:

(a) the relative positions of centroids of the above features are defined by the following Cartesian coordinates in Å:

- (i) first hydrogen bond acceptor, 0.00, 0.00, 0.00;
- (ii) second hydrogen bond acceptor, 5.08, 2.23, 0.0;
- (iii) third hydrogen bond acceptor, 7.15, 0.80, 0.00;
- (iv) first hydrophobic group, -1.52, -3.06, -0.23; and

(b) tolerances in the positions of the hydrophobic group and the hydrogen bond acceptors are $\pm 1.0 \text{ \AA}$ and $\pm 1.5 \text{ \AA}$ respectively.

10. The compound of claim 9, wherein the first hydrophobic group contains a bicyclic ring system containing between 8 and 10 atoms and which may contain one or several heteroatoms, or a 5- or 6-membered monocyclic aromatic group which may contain one or more heteroatoms and which may be 4-substituted or 3,4-disubstituted, but which is of width (including substituents) less than 4.0 Å.

Sub Bl

11. The compound of claim 10, wherein the pi-system of the aromatic ring is electron rich.

5 12. The compound of claim 10, wherein first hydrophobic group, is linked by a first linker chain which is three atoms long to a first 5- or 6-membered ring of the scaffold, the first linker chain atom adjacent to said first scaffold ring forming part of the first hydrogen bond acceptor.

10 13. The compound of claim 12, wherein the chain has a methylene group located adjacent to the hydrophobic group.

14. The compound of claim 12, wherein the scaffold further comprises a second ring fused to the first scaffold ring at locations two and three ring atoms distant from the junction between the first scaffold ring and the chain, and the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is two positions distant from said junction forms part of the second hydrogen bond acceptor.

15 15. The compound of claim 14, wherein the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is three positions distant from said junction has a substituent which is a single atom or is a methyl group.

20 16. The compound of claim 14, wherein the second scaffold ring is 6-membered and the atom of the second scaffold ring that is two positions distant from the atom that forms part of the second hydrogen bond acceptor forms part of the third hydrogen bond acceptor.

25 17. The compound of claim 14, wherein the second scaffold ring is 6-membered and a third scaffold ring is fused to the second scaffold ring at those atoms of the second scaffold ring which are two and three positions distant from

the atom that forms part of the second hydrogen bond acceptor, an atom of the third scaffold ring forming part of the third hydrogen bond acceptor.

18. A compound that binds allosterically to MMP-13 and that comprises first
5 and second hydrophobic groups and first, second and third hydrogen bond
acceptors, wherein:

(a) the relative positions of centroids of the above features are defined
by the following Cartesian coordinates in Å:

10 (i) first hydrogen bond acceptor, 0.00, 0.00, 0.00;
(ii) second hydrogen bond acceptor, 5.08, 2.23, 0.0;
(iii) third hydrogen bond acceptor, 7.15, 0.80, 0.00;
(iv) first hydrophobic group, -1.52, -3.06, -0.23;
(v) second hydrophobic group, 9.07, 0.00, 0.00; and
15 (b) tolerances in the positions of the hydrophobic groups and the
hydrogen bond acceptors are $\pm 1.0 \text{ \AA}$ and $\pm 1.5 \text{ \AA}$ respectively.

19. The compound of claim 18, wherein the first hydrophobic group contains a
bicyclic ring system containing between 8 and 10 atoms and which may contain
20 one or several heteroatoms, or a 5- or 6-membered monocyclic aromatic group
which may contain one or more heteroatoms and which may be 4-substituted or
3,4-disubstituted, but which is of width (including substituents) less than 4.0 Å.

20. The compound of claim 19, wherein the pi-system of the aromatic ring is
electron rich.

25 21. The compound of claim 19, wherein first hydrophobic group, is linked by
a first linker chain which is three atoms long to a first 5- or 6-membered ring of
the scaffold, the first linker chain atom adjacent to said first scaffold ring forming
part of the first hydrogen bond acceptor.

30 22. The compound of claim 21, wherein the chain has a methylene group
located adjacent to the hydrophobic group.

23. The compound of claim 21, wherein the scaffold further comprises a second scaffold ring fused to the first scaffold ring at locations two and three ring atoms distant from the junction between the first scaffold ring and the first linker
5 chain, and the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is two positions distant from said junction forms part of the second hydrogen bond acceptor.

24. The compound of claim 23, wherein the atom of the second scaffold ring adjacent to the atom of the first scaffold ring that is three positions distant from
10 said junction has a substituent which is a single atom or is a methyl group.

25. The compound of claim 23, wherein the second scaffold ring is 6-membered and the atom of the second scaffold ring that is two positions distant
15 from the atom that forms part of the second hydrogen bond acceptor forms part of the third hydrogen bond acceptor.

26. The compound of claim 23, wherein the second scaffold ring is 6-membered and a third scaffold ring is fused to the second scaffold ring at those
20 atoms of the second scaffold ring which are two and three positions distant from the atom that forms part of the second hydrogen bond acceptor, an atom of the third scaffold ring forming part of the third hydrogen bond acceptor.

27. The compound of claim 18, wherein the second hydrophobic group is a 5-
25 or 6-membered aromatic ring which may contain one or several heteroatoms, a bicyclic ring system containing between 8 and 10 atoms and which may contain one or several heteroatoms, or a planar saturated or unsaturated system.

28. A ligand that binds allosterically to MMP-13 and that comprises a
30 scaffold, first and second hydrogen bond acceptors and first and second hydrophobic groups connected by side chains to the scaffold, a cyclic structure forming part of the scaffold being located between the first and second hydrogen

Sub b1

bond acceptors, and the hydrogen bond acceptors and hydrophobic groups being arranged so that when the ligand binds to MMP-13:

the first and second hydrogen bond acceptors bond respectively with Thr245, Thr 247;

5 the first hydrophobic group locates within the S1' channel; and the second hydrophobic group is relatively open to solvent.

29. A ligand that binds allosterically to MMP-13 and that comprises a scaffold, first, second and third hydrogen bond acceptors, and a hydrophobic group connected by a side chain to the scaffold, a cyclic structure forming part of the scaffold being located between the first and second hydrogen bond acceptors, and the hydrogen bond acceptors and hydrophobic group being arranged so that when the ligand binds to MMP-13:

the first, second and third hydrogen bond acceptors bond respectively with

10 Thr245, Thr 247 and Met253; and

the first hydrophobic group locates within the S1' channel.

30. A ligand that binds allosterically to MMP-13 and that comprises a scaffold, first, second and third hydrogen bond acceptors, and first and second hydrophobic groups connected by side chains to the scaffold, a cyclic structure forming part of the scaffold being located between the first and second hydrogen bond acceptors, and the hydrogen bond acceptors and hydrophobic groups being arranged so that when the ligand binds to MMP-13:

the first, second and third hydrogen bond acceptors bond respectively with

25 Thr245, Thr 247 and Met 253;

the first hydrophobic group locates within the S1' channel; and

the second hydrophobic group is open to solvent.

31. A ligand that binds allosterically to the S1' and S1" pockets of MMP 13.

30

32. The ligand of claim 31, wherein the S1" pocket is defined by amino acid residues from Tyr246 to Pro255.

*Sub
B1*

33. A pharmaceutical composition comprising a compound as claimed in claim 1 claim and a pharmaceutically acceptable excipient.

34. A pharmaceutical composition comprising a compound as claimed in 5 claim 9 and a pharmaceutically acceptable excipient.

35. A pharmaceutical composition comprising a compound as claimed in claim 18 and a pharmaceutically acceptable excipient.

10 36. Use of a compound according to claim 1 for the preparation of a medicament for the treatment of a disease by inhibition of MMP-13.

15 37. Use of a compound according to claim 1 for the manufacture of a medicament for the treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease, psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration or cancer.

20 38. A method of treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease, psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration or cancer which comprises administering to a patient an effective amount of a 25 compound as defined in claim 1.

39. Use of a compound according to claims 9 for the preparation of a medicament for the treatment of a disease by inhibition of MMP-13.

30 40. Use of a compound according to claim 9 for the manufacture of a medicament for the treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease,

psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration or cancer.

5 41. A method of treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease, psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration or cancer which comprises administering to a patient an effective amount of a
10 compound as defined claim 9.

42. Use of a compound according to claim 18 for the preparation of a medicament for the treatment of a disease by inhibition of MMP-13.

15 43. Use of a compound according to claim 18 for the manufacture of a medicament for the treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease, psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration
20 or cancer.

44. A method of treatment of any of arthritis, rheumatoid arthritis, osteoarthritis, osteoporosis, periodontal disease, inflammatory bowel disease, psoriasis, multiple sclerosis, cardiac insufficiency, atherosclerosis, asthma, chronic obstructive pulmonary disease (COPD), age-related macular degeneration or cancer which comprises administering to a patient an effective amount of a compound as defined in claim 18.

25 45. Use of a MMP-13 inhibitor compound docking solely into the S1' pocket of the MMP-13 enzyme for the preparation of a medicament for the treatment of a disease by inhibition of MMP-13.